

## Supplementary Information

### Ocean acidification reduces transfer of essential biomolecules in a natural plankton community

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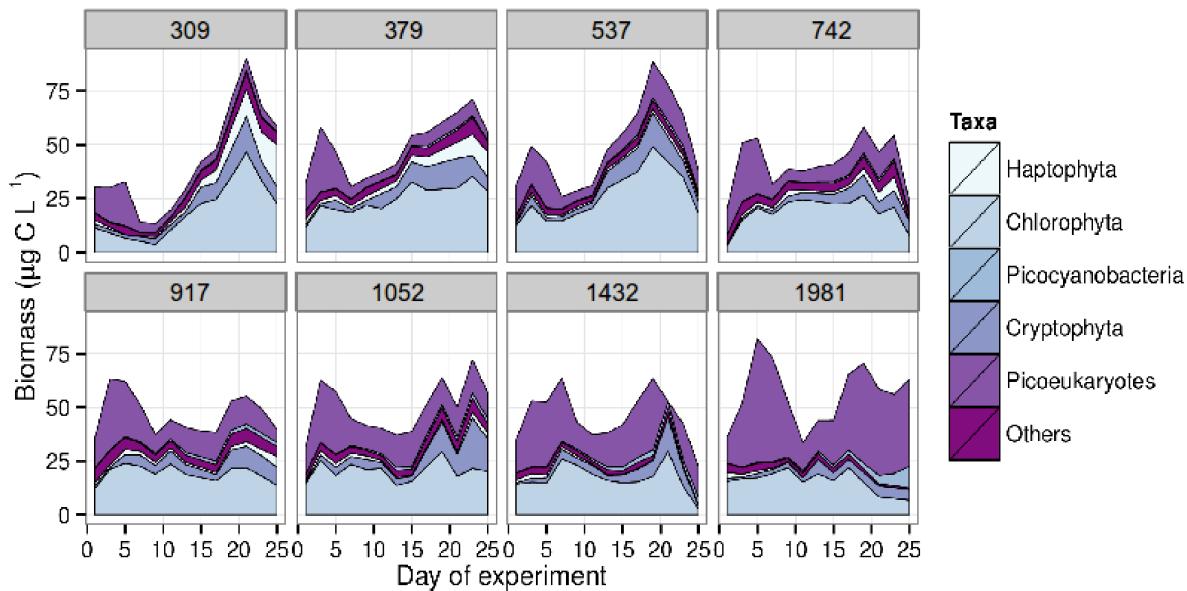
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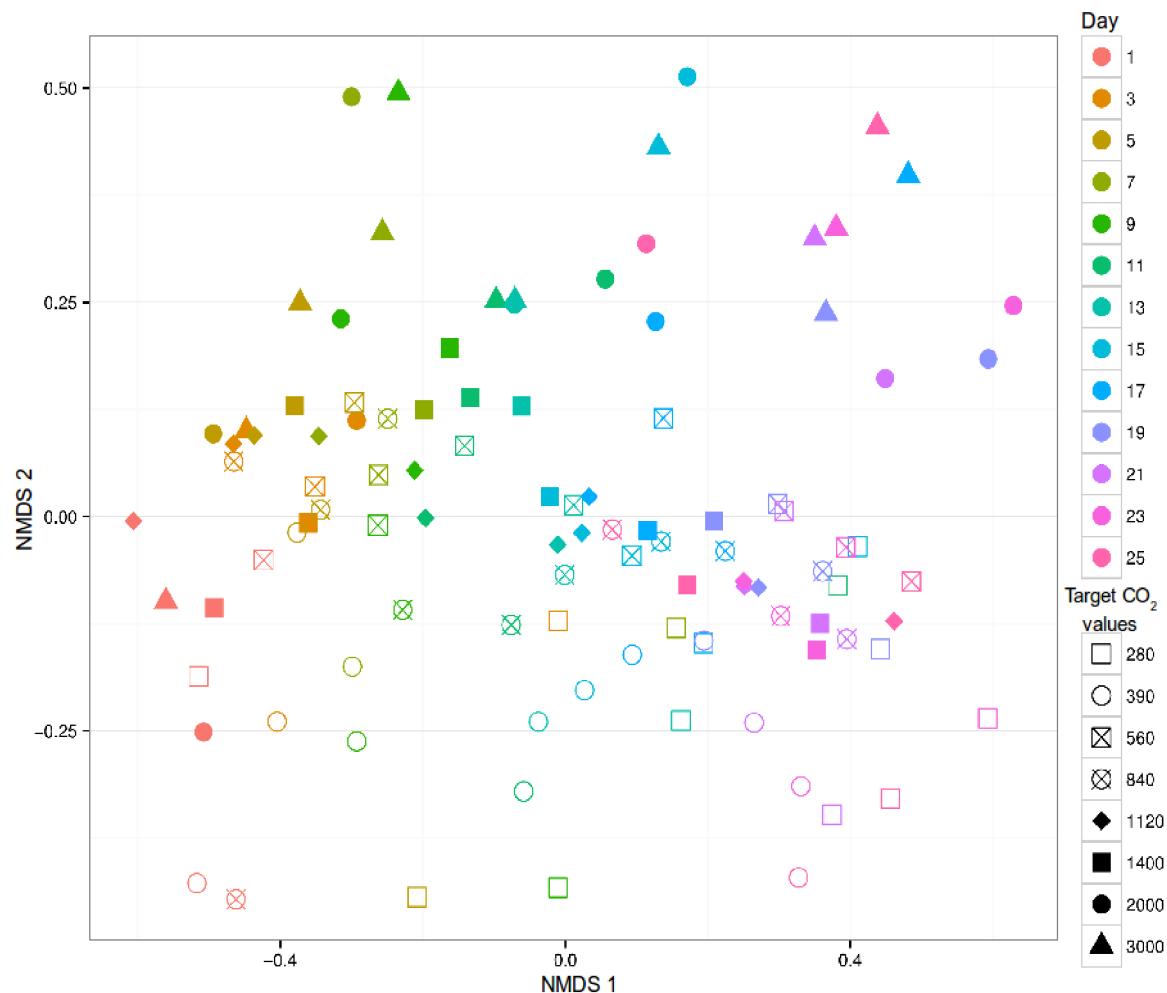
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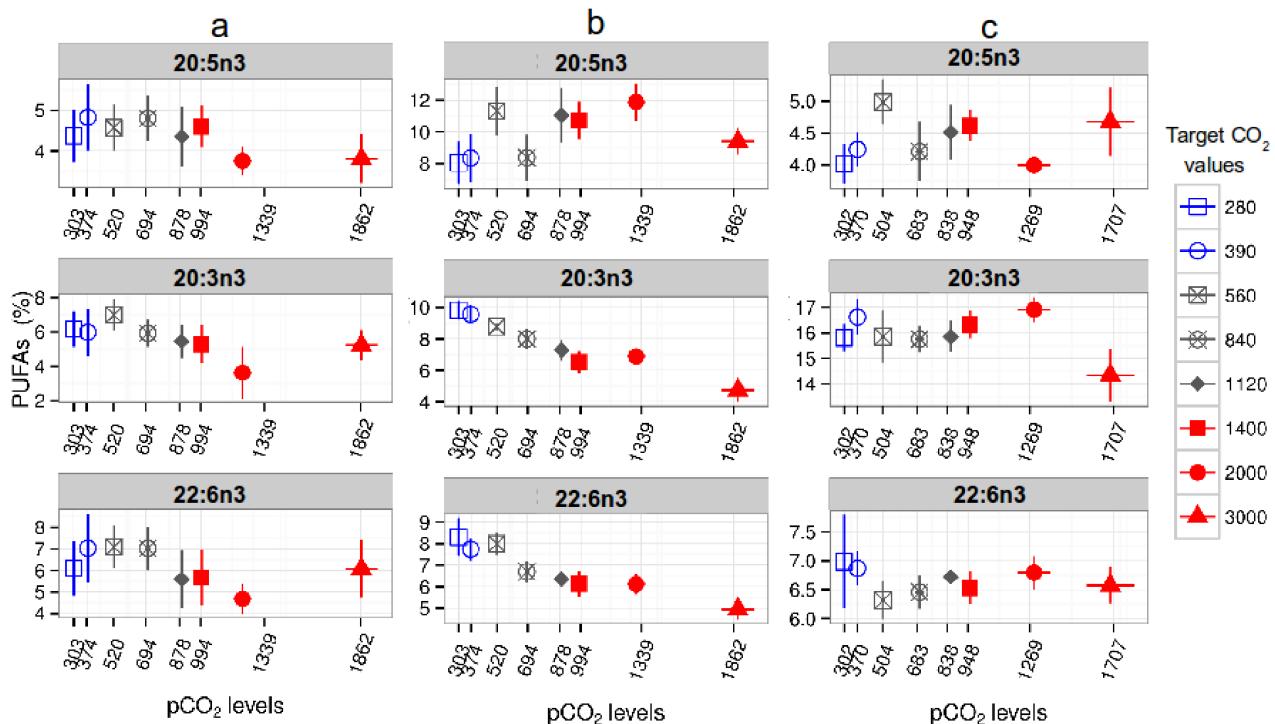
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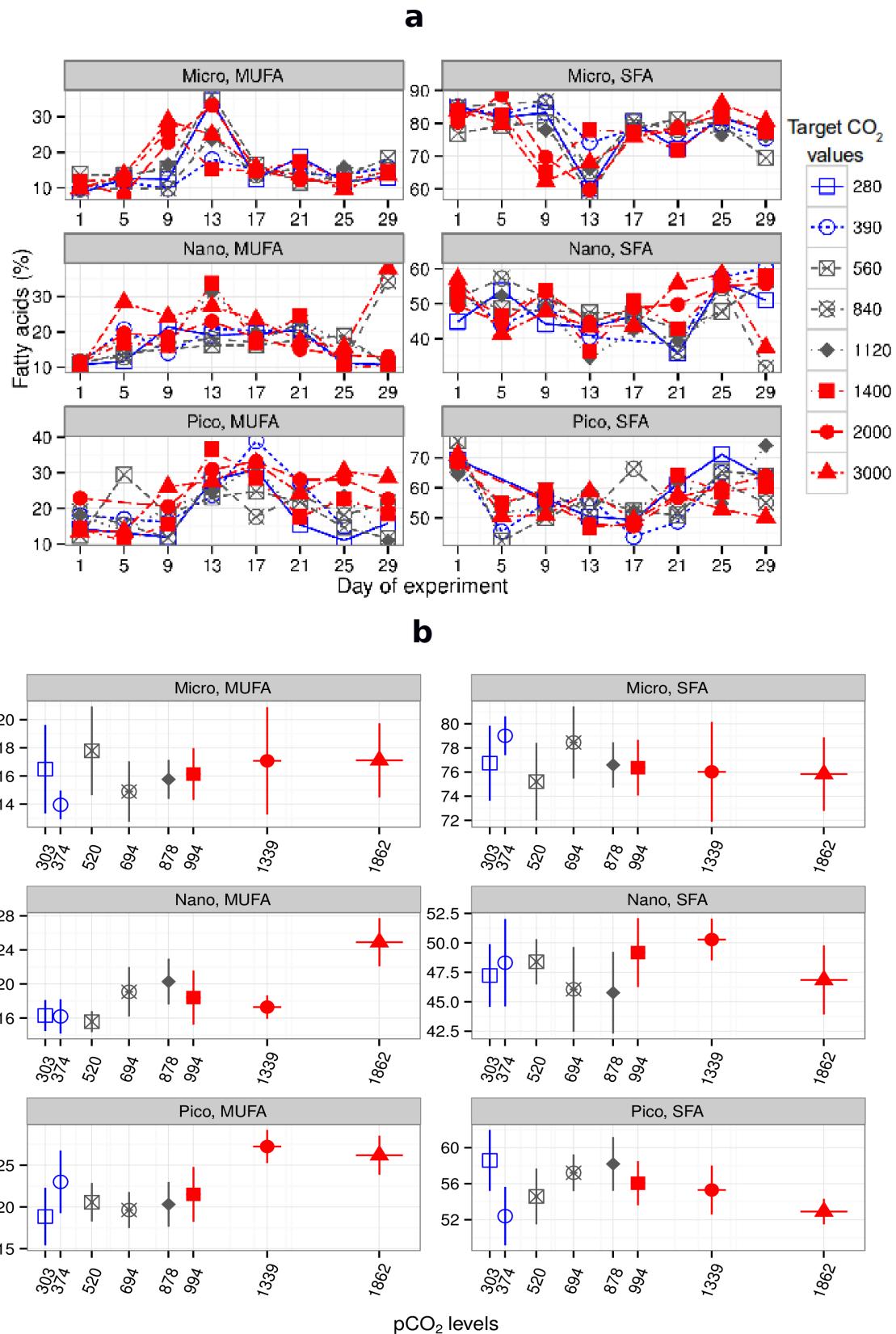
**Figure S1:** Plankton biomass of the dominant taxonomic groups in the different CO<sub>2</sub> treatments. Each treatment is labelled with its target CO<sub>2</sub> level (top,  $\mu\text{atm}$ ). Nutrients were added at day 14. Phytoplankton biomass displayed a short-lived small bloom at the start of the experiment and a more pronounced bloom after nutrient addition.



**Figure S2:** Non Metrical Multidimensional Scaling (NMDS) of the plankton community composition in terms of calculated biomass change through sampling days and CO<sub>2</sub> treatment. The NMDS 1 axis show that the phytoplankton communities strongly diverge through time, while the NMDS 2 axis show that the communities split between high (top) and low (bottom) CO<sub>2</sub> treatment levels. An Analysis of Similarity showed a significant difference on community composition between days (ANOSIM statistic R: 0.4, p= 0.0002) while the analysis between CO<sub>2</sub> treatments although significant was weaker (ANOSIM R: 0.17, p= 0.0002).



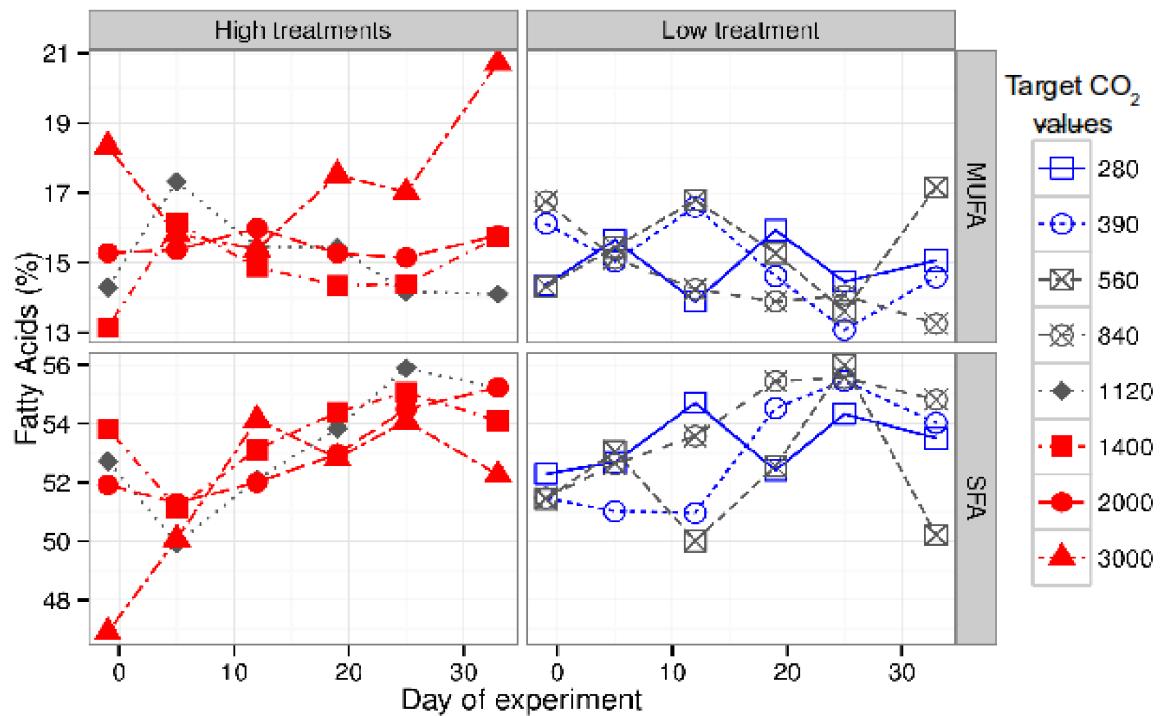
**Figure S3:** Relative content of the most abundant PUFA in the pico-size (a), nano-size (b) and *Calanus finmarchicus* (c) during the experiment (pico-size: 0.3-2.7 µm, nano-size: 2.7-10 µm) in the different pCO<sub>2</sub> treatments during the experiment. A mixed effect model analysis (MEM) showed that 20:5n3 presented no CO<sub>2</sub> related effect in any group ( $p>0.05$ ). The 20:3n3 showed a CO<sub>2</sub> effect in the nano size fractions (MEM,  $F=10.33$ ,  $p<0.05$ ) and *C. finmarchicus* (MEM,  $F=8.21$ ,  $p<0.05$ ). The 22:6n3 showed a significant CO<sub>2</sub> effect only in the Nano-size fraction (MEM,  $F=11.86$ ,  $p<0.05$ ).



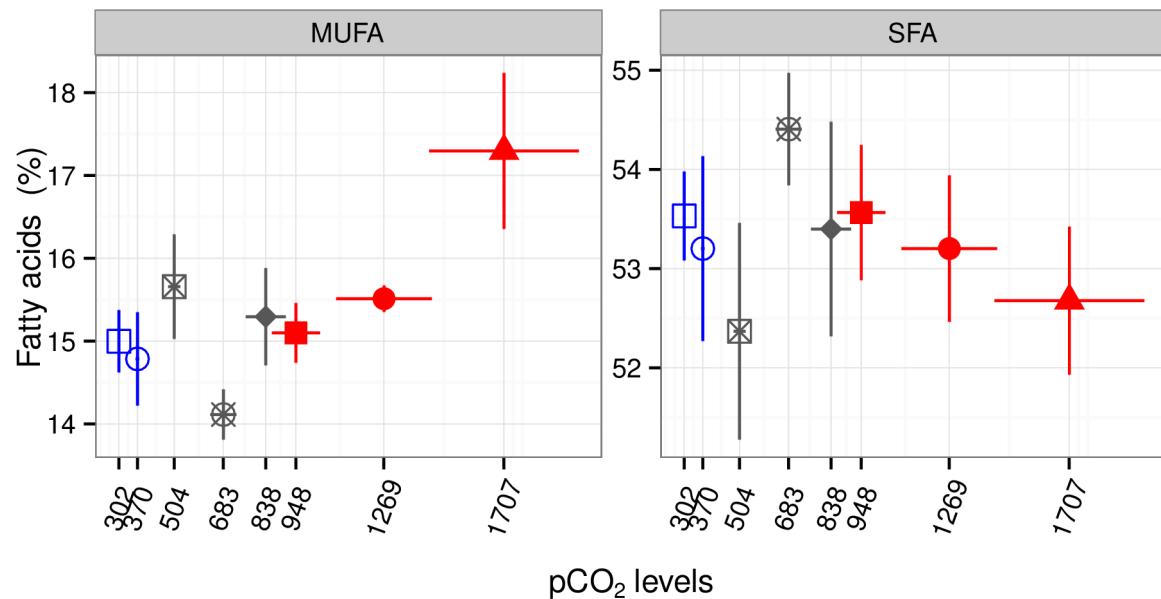
**Figure S4:** Relative plankton MUFA and SFA content during the experiment in different size fractions (micro: 10-100  $\mu\text{m}$ , nano: 2.7-10  $\mu\text{m}$ , pico: 0.3-2.7  $\mu\text{m}$ ) a)

through time, and b) in the different  $p\text{CO}_2$  treatments.

**a**



**b**



**Figure S5:** Relative MUFA and SFA content in the copepod *Calanus finmarchicus* a) through time, and b) in the different  $p\text{CO}_2$  treatments.

**Table S1:** Ratios of different FA classes of the copepod *Calanus finmarchicus* and to different phytoplankton size fractions (micro: >10 µm, nano: 2.7-10 µm,pico: <2.7 µm) at day 1 and day 25. Ratios are shown for Saturated (SFA), Monounsaturated (MUFA) and Polyunsaturated (PUFA) fatty acids. Values in bold font type highlighted the similarity between *C. finmarchicus* and the nano-size phytoplankton fraction.

<b>Day 1</b>	SFA:PUFA	sd	SFA:MUFA	sd	MUFA:PUFA	sd
<i>Calanus</i>	<b>1.56</b>	<b>0.12</b>	<b>3.58</b>	<b>0.28</b>	<b>0.44</b>	<b>0.04</b>
Micro-fraction	14.69	3.7	8.05	1.39	1.75	0.45
Nano-fraction	<b>1.38</b>	<b>0.21</b>	<b>4.67</b>	<b>0.54</b>	<b>0.29</b>	<b>0.02</b>
Pico-fraction	5.06	1.37	4.35	1.06	1.25	0.59
<b>Day 25</b>						
<i>Calanus</i>	<b>1.81</b>	<b>0.04</b>	<b>3.82</b>	<b>0.33</b>	<b>0.48</b>	0.05
Micro-fraction	13.28	3.01	6.79	1.25	1.95	0.16
Nano-fraction	<b>1.74</b>	<b>0.26</b>	<b>4.45</b>	<b>1.09</b>	<b>0.41</b>	<b>0.12</b>
Pico-fraction	3.44	0.78	3.43	1.58	1.19	0.62

**Table S2:** Physical variables measured during the experiment when FA seston samples were taken. Nitrate, phosphate, silicate and ammonia are given in  $\mu\text{mol l}^{-1}$  and pH in total scale.

Mesocosm	Target $\text{CO}_2$	Day	Temperature ( $^{\circ}\text{C}$ )	pCO2 ( $\mu\text{atm}$ )	pH	Nitrate	Phosphate	Silicate	Ammonia
M1	840	1	8.57	464.39	7.73	1.70	0.16	1.13	0.20
M1	840	5	9.47	891.40	7.50	0.49	0.08	0.80	0.05
M1	840	9	9.24	810.33	7.53	0.20	0.06	0.50	0.08
M1	840	13	9.84	745.51	7.56	0.20	0.07	0.45	0.13
M1	840	17	9.72	711.52	7.59	4.31	0.15	0.34	0.10
M1	840	21	9.68	623.95	7.64	1.90	0.04	0.04	0.07
M1	840	25	9.75	606.31	7.65	1.50	0.05	0.08	0.20
M1	840	29	NA	535.99	7.65	1.30	0.06	0.06	0.34
M3	1120	1	8.62	453.71	7.74	1.30	0.14	1.07	0.19
M3	1120	5	9.52	1168.60	7.41	0.39	0.06	0.77	0.08
M3	1120	9	9.25	1042.56	7.47	0.10	0.05	0.50	0.05
M3	1120	13	9.84	920.16	7.50	0.10	0.05	0.41	0.05
M3	1120	17	9.71	848.38	7.53	4.41	0.13	0.26	0.10
M3	1120	21	9.69	762.68	7.56	2.40	0.04	0.03	0.07
M3	1120	25	9.74	742.88	7.57	1.90	0.08	0.08	0.12
M3	1120	29	NA	621.29	7.58	1.80	0.07	0.06	0.36
M4	280	1	8.62	323.94	7.86	1.60	0.15	1.13	0.18
M4	280	5	9.52	300.03	7.89	0.59	0.08	0.80	0.12
M4	280	9	9.25	304.92	7.89	0.31	0.07	0.56	0.13
M4	280	13	9.85	319.20	7.88	0.10	0.06	0.52	0.16
M4	280	17	9.72	319.71	7.88	4.71	0.19	0.51	0.12
M4	280	21	9.69	299.58	7.90	2.50	0.05	0.18	0.10
M4	280	25	9.73	292.62	7.91	2.20	0.09	0.22	0.25
M4	280	29	NA	284.07	7.92	1.50	0.09	0.16	0.38
M5	1400	1	8.62	471.56	7.72	1.50	0.16	1.16	0.26
M5	1400	5	9.51	1324.86	7.33	0.49	0.08	0.80	0.05
M5	1400	9	9.28	1227.31	7.38	0.10	0.06	0.48	0.07
M5	1400	13	9.84	1101.05	7.43	0.10	0.04	0.35	0.10
M5	1400	17	9.72	967.45	7.48	4.31	0.12	0.16	0.12
M5	1400	21	9.69	854.84	7.52	3.20	0.06	0.02	0.19
M5	1400	25	9.74	826.70	7.54	2.00	0.07	0.07	0.20
M5	1400	29	NA	662.00	7.54	1.70	0.07	0.05	0.35
M6	390	1	8.62	373.88	7.81	1.50	0.17	1.11	0.22
M6	390	5	9.52	394.11	7.80	0.49	0.08	0.79	0.06
M6	390	9	9.26	392.27	7.81	0.20	0.07	0.62	0.11
M6	390	13	9.83	393.84	7.81	0.10	0.05	0.57	0.13
M6	390	17	9.72	390.08	7.81	4.31	0.13	0.43	0.14
M6	390	21	9.71	355.85	7.85	2.60	0.06	0.19	0.07
M6	390	25	9.73	353.47	7.85	1.80	0.04	0.20	0.23
M6	390	29	NA	334.87	7.84	1.40	0.04	0.13	0.24
M7	2000	1	8.62	454.67	7.74	1.30	0.15	1.07	0.21
M7	2000	5	9.51	2065.92	7.20	0.29	0.07	0.79	0.03
M7	2000	9	9.25	1746.04	7.25	0.10	0.05	0.51	0.05
M7	2000	13	9.83	1539.45	7.31	0.10	0.04	0.42	0.07
M7	2000	17	9.72	1260.96	7.38	4.31	0.13	0.24	0.03
M7	2000	21	9.71	1133.00	7.42	2.10	0.04	0.03	0.12
M7	2000	25	9.73	922.60	7.49	1.90	0.04	0.09	0.22
M7	2000	29	NA	753.07	7.50	1.50	0.04	0.02	0.23
M8	560	1	8.62	465.18	7.73	1.20	0.18	1.04	0.06
M8	560	5	9.53	594.55	7.65	0.39	0.07	0.79	0.03
M8	560	9	9.26	568.96	7.67	0.20	0.09	0.63	0.11
M8	560	13	9.85	570.57	7.67	0.10	0.07	0.55	0.11
M8	560	17	9.72	532.43	7.70	4.41	0.15	0.42	0.08
M8	560	21	9.72	484.37	7.73	2.60	0.05	0.12	0.03
M8	560	25	9.73	466.94	7.74	1.70	0.05	0.15	0.19
M8	560	29	NA	442.62	7.74	1.30	0.05	0.11	0.24
M9	3000	1	8.63	468.91	7.72	1.30	0.16	1.08	0.05
M9	3000	5	9.53	3056.76	7.05	0.29	0.08	0.85	0.01
M9	3000	9	9.27	2570.59	7.11	0.10	0.06	0.59	0.05
M9	3000	13	9.85	2095.81	7.19	0.10	0.04	0.50	0.08
M9	3000	17	9.72	1645.23	7.28	4.51	0.14	0.42	0.10
M9	3000	21	9.71	1541.59	7.31	3.50	0.06	0.26	0.09
M9	3000	25	9.72	1197.49	7.40	1.90	0.05	0.28	0.05
M9	3000	29	NA	932.22	7.35	1.00	0.05	0.16	0.01

**Table S3:** Phytoplankton species identified in the mesocosms and their size class.

Genus	Species	Taxa	Size class
<i>Flagellates</i>	<i>sp. 1</i>	Chlorophyta	Micro
<i>Flagellates</i>	<i>sp. 2</i>	Chlorophyta	Micro
<i>Pterosperma</i>	<i>sp.</i>	Chlorophyta	Micro
<i>Plagioselmis</i>	<i>prolonga</i>	Cryptophyta	Micro
<i>Leucocryptos</i>	<i>marina</i>	Cryptophyta	Micro
<i>Leucocryptos</i>	<i>remigera</i>	Cryptophyta	Micro
<i>Azadinium</i>	<i>sp.</i>	Dinophyta	Micro
<i>Gyrodinium</i>	<i>estuariale</i>	Dinophyta	Micro
<i>Gymnodinium</i>	<i>ostenfeldii</i>	Dinophyta	Micro
<i>Gymnodinium</i>	<i>ostenfeldii</i>	Dinophyta	Micro
<i>Protoperidinium</i>	<i>bipes</i>	Dinophyta	Micro
<i>Ceratium</i>	<i>tripos</i>	Dinophyta	Micro
<i>Ceratium</i>	<i>longipes</i>	Dinophyta	Micro
<i>Ceratium</i>	<i>fusus</i>	Dinophyta	Micro
<i>Protoperidinium</i>	<i>depressum</i>	Dinophyta	Micro
<i>Dinophysis</i>	<i>norvegica</i>	Dinophyta	Micro
<i>Dinophysis</i>	<i>acuminata</i>	Dinophyta	Micro
<i>Dinoflagellate</i>	<i>unknown</i>	Dinophyta	Micro
<i>Eutreptiella</i>	<i>braarudii</i>	Euglenophyta	Micro
<i>Flagellate</i>	<i>euglena</i>	Euglenophyta	Micro
<i>Calciopappus</i>	<i>caudatus</i>	Haptophyta	Micro
<i>Navicula</i>	<i>sp.</i>	Haptophyta	Micro
<i>Skeletonema</i>	<i>sp.</i>	Heterokontophyta	Micro
<i>Nitzchia</i>	<i>longissima</i>	Heterokontophyta	Micro
<i>Pseudonitzchia</i>	<i>sp.</i>	Heterokontophyta	Micro
<i>Chaetoceros</i>	<i>borealis</i>	Heterokontophyta	Micro
<i>Chaetoceros</i>	<i>danicus</i>	Heterokontophyta	Micro
<i>Coscinodiscus</i>	<i>sp.</i>	Heterokontophyta	Micro
<i>Chaetoceros</i>	<i>decipiens</i>	Heterokontophyta	Micro
<i>Thalassiosira</i>	<i>sp.</i>	Heterokontophyta	Micro
<i>Pseudopedinella</i>	<i>pyriformis</i>	Heterokontophyta	Micro
<i>Chlamidomonas</i>	<i>sp.</i>	Chlorophyta	Nano
<i>Flagellates</i>	<i>sp. 3</i>	Chlorophyta	Nano
<i>Flagellates</i>	<i>sp. 4</i>	Chlorophyta	Nano
<i>Crypto</i>	<i>sp. 6</i>	Cryptophyta	Nano
<i>Emiliania</i>	<i>huxleyi</i>	Haptophyta	Nano
<i>Arcocellulus</i>	<i>sp.</i>	Heterokontophyta	Nano
<i>Synechococcus</i>	<i>sp.</i>	Cyanobacteria	Pico
<i>Picoeucariot</i>	<i>sp.</i>	Picoeucariot	Pico